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West Virginia University
Agricultural Experiment Station
MORGANTOWN, W. VA.

Small Fruits for Home and
Commercial Planting



Strawberry Variety Test Plats at the W. Va. Experiment Station,
Showing a Few of the 96 Varieties Under Test.

BY
L. F. SUTTON

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Small Fruits for Home and Commercial Planting

By L. F. SUTTON

INTRODUCTION.

Senator J. H. Hale, the "Peach King", once wrote the following:

"No man should fool himself into telling his wife that he hasn't time to bother with such trash as berries but will buy all the family wants; he may not be much of a liar, but those of us who have so often heard that old chestnut about buying all the berries the family wants, know that that man is away off. He never did and never will buy one-tenth part as many berries as the family will consume, if he will give them all they will use right straight from the patch".

Mr. Hale is right and the census report for 1910 which gives the small fruit production in West Virginia as follows, shows that West Virginians are not growing all of these fruits that they should:

Grapes	2.63 pounds per person
Strawberries	.66 quarts per person
Blackberries	.65 quarts per person
Raspberries	.53 ¹ / ₂ quarts per person

Many people may think this estimate of production is not high enough, but let them travel through the farming sections and visit the cities and villages at harvest time and the fact will be emphasized that thousands of homes are doing without these healthful appetizing fruits.

The experience of V. B. Lowther, of Brandville, living about seven miles from West Union, proves that the farmers do not enjoy the luxuries of the small fruit garden as extensively as they should. Mr. Lowther was instructed in strawberry growing by a "preacher" who had made a success in the strawberry industry. He planted 1-7 acre, approximately, in a fertile cove; gave it frequent cultivation and kept the weeds completely subdued, and from the first crop he harvested and sold to the neighboring farmers, at the patch, \$80.00 worth, besides using and canning enough for a family of seven.

Not only are the small fruits frequently omitted from the home plantings but the cities and villages of the state have to depend largely upon growers from outside the state for their supply. This is verified by the results of an extensive investigation of the receipts of 75 different articles from outside the state by 76 cities and towns of West Virginia. While for many of the towns mentioned, the data for small fruits is incomplete, it shows that from September 30, 1907, to October 1, 1908, there were 31,896 crates of small fruits valued at \$74,869 received from outside the state; and during the year ending October 1, 1909, the same cities and towns imported 50,246 crates valued at \$115,457. While there is no data available from which to calculate the increase during the last six years, it seems that the home production has not kept pace with the increase in population. The industrial development has furnished employment for many persons who would be growing these fruits, had the wages from the industries been less remunerative. Thousands of persons have come into the state to engage in coal mining near Charleston, Bluefield, Clarksburg, Fairmont, Morgantown and other cities, and have created increased demands for these fruits.

Poultrymen, dairymen, and general farmers frequently find the growing of grapes and small fruits a valuable sideline.

REASONS FOR GROWING SMALL FRUITS

1. They add to the attractiveness of the home. The cry "Back to the Farm", is heard on every hand. But we should, rather, make the home and surroundings such as to keep more of our boys and girls interested in farm life. Strawberry short-cake, raspberry pie, blackberries with sugar and cream, and a patch all their own will do much to keep the boys and girls at home.

2. They are healthful. Physicians frequently recommend more extensive use by their patients of fresh fruits, especially the juices.

3. Small fruits ripen early and continue for a long season. The following table shows the approximate ripening season for Morgantown at an elevation of about 1100 feet. For other sections of the state allowance should be made for difference in altitude and latitude.

FRUIT	DATE OF RIPENING
Strawberry -----	May 25th to July 1st
Black Raspberry -----	June 20th to July 5th
Red Raspberry -----	June 22nd to July 10th
Currant -----	June 25th to July 5th
Purple Cane Raspberry-----	July 1st to August 1st
Gooseberry—Ripe-----	July 5th to July 20th
Blackberry-----	July 5th to August 15th
Grape -----	August 10th to frost

4. They come into bearing quickly. It requires one year for strawberries and brambles, 2 to 3 years for currants and gooseberries, and 3 to 4 years for grapes to produce profitable crops.

5. These fruits are hardy. They need little or no protection in West Virginia.

6. In case a surplus is produced, a ready market may be found.

7. These fruits have been found profitable when grown either on a large or on a small scale. Some people have produced them successfully where the acreage was as great as 150 acres, and others growing only 1-4 acre have also found small fruits to be profitable. The increasing demand for these fruits insures a good future for that line of fruit growing.

The following fruits are discussed in this circular: Strawberries, raspberries, blackberries, currants, and gooseberries. Lack of space will permit only a brief mention of the vital points in the production of each.

STRAWBERRIES

The strawberry is the first fruit to ripen. Its attractive appearance, rich flavor and health-giving qualities make the strawberry highly appreciated.

Origin. The strawberry as commonly cultivated is strictly American. It was found growing wild on our mountains and in our valleys by the early settlers, but these native North American berries did not prove popular in gardens. About 1712 a strawberry was introduced into Europe from Chili, (the botanical name for the strawberry being *Fragaria*,

the botanist called this species from Chili, *Fragaria chiloensis*). From Europe this strawberry was imported to North America and became the source of almost all cultivated varieties. Plant breeders are constantly improving this berry. Such improvements have been made that the strawberry will now produce more bushels per acre than will wheat, oats or corn.

Varieties. In selecting varieties for the home garden those having high quality should have preference. A group of varieties which will give the longest possible ripening period should be selected. In deciding which to plant be sure to get some **perfect** varieties, that is, those varieties which have both stamens and pistils in the blossom. The imperfect

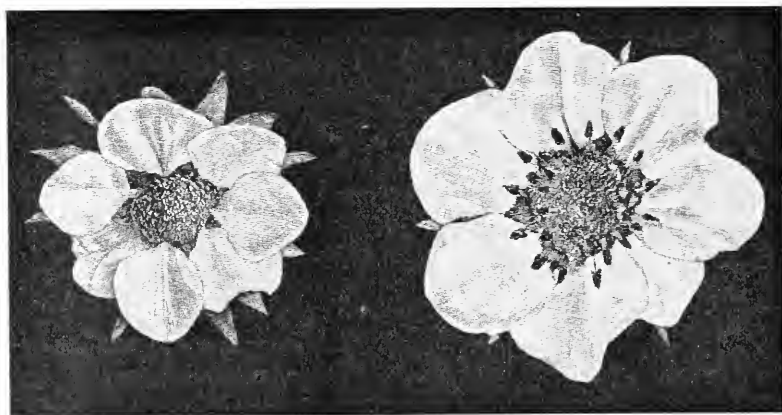


Fig. 1—Showing a Perfect Flower, at the Right, and an Imperfect Flower at the Left. Note the Large Stamens in the Perfect Flower.

varieties have the pistils and not the stamens and will not produce fruit unless fertilized by pollen from other plants having both stamens and pistils. The common method of arranging the varieties where the imperfect is preferred, is to plant two rows of the imperfect variety, then one or more of the perfect, and so on. The following list of varieties may prove helpful in determining which to select. They have all been under test at the Experiment Station and are among the most promising of the 100 varieties tested:

Extra Early Varieties—Luther (August), (Perfect); Michel, (Per.); Clark, (Per.); Early Ozark, (Per.).

Early Varieties—Dunlap (Senator), (Per.); Parson, (Per.); Glen Mary (Per.) Haverland, (Imperfect).

Mid-Season Varieties—Klondike, (Per.); Belt (William), (Per.).

Late Varieties—Sample, (Imp.); Chesapeake, (Per.); Aroma, (Per.).

Very Late Varieties—Gandy, (Per.); Uncle Jim, (Per.)

Suggested for Home Plantings—Luther, Dunlap or Parson, Belt and Sample; in the order of ripening.

Commercial Planting—Parson, Sample, and Aroma; or Dunlap, Klondike, Sample and Aroma.

Propagation—The strawberry does not come true to type when grown from seeds, hence for new varieties seed propagation is used. But for commercial purposes the common varieties are propagated by runners, or stolons and those fall-bearing varieties not producing runners, by division. Only plants produced the past season should be used for planting. Throw away all black rooted plants, because they are either too old or are diseased and will not prove satisfactory.

Site—For the home fruit garden the patch should be as convenient as possible to the house. In selecting the place close to the house, the type of soil, the exposure and the elevation cannot always be given much consideration. It is better to have reduced yields, with the patch close where the boy or girl, grandfather or grandmother, mother or father, may quickly and easily get the berries, than to have large yields in some ideal spot which is inaccessible. But for the commercial plantings due consideration should be given the various factors.

Soil and its Preparation—Perhaps the best type of soil is a deep, fertile sandy loam, with a porous subsoil to insure drainage. This type of soil seems well suited to all kinds of small fruits, which as a matter of fact may be grown on almost all types of soil. Land which has been in grass for years should be planted to corn, potatoes or other cultivated crops one year to control grubs and cut worms before plant-

ing to strawberries. New ground produces good crops of strawberries but is easier worked to that crop after being cultivated to corn for one or two seasons.

Whatever the type of soil the following factors will prove important:

1. **Drainage.** Air drainage is important and may be provided by selecting an elevated site below which there is nothing in the nature of trees, etc. to interfere with the air circulation. If the soil is water logged, or springy, artificial drainage should be provided before planting to fruits of any kind.

2. **Humus.** To provide an abundance of humus is to insure a good moisture supply, the liberation of plant food,

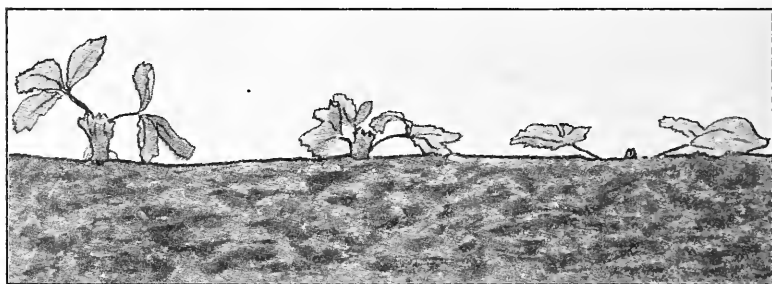


Fig. 2—Three Depths of Planting the Strawberry:
Not Deep Enough, Just Right, and Too Deep.

and large crops. The strawberry is more than 80% water, and the experience of growers indicates that a constant and abundant supply of moisture is necessary both for plant growth and to mature a good crop of fruit. The organic matter so necessary may be supplied by applications of manure at the rate of 20 to 30 tons per acre; or by turning under cover crops of rye, vetch, clovers, etc. A good plan where the soil is low in the organic content is to spend a year in growing and turning under cover crops. In the fall after taking off the wheat or other crop, sow two bushels of rye, or twenty pounds of crimson clover. The following spring, after a heavy growth has been made disk up and plow under, and sow to cowpeas or soy beans about June first. About August first to fifteenth turn in hogs to eat off the peas and beans, and in about two weeks disk the vines and turn under,

after which another sowing of crimson clover or rye may be made to turn under the following spring. Should this make the soil acid it will not injure the strawberry plants which seem to do best on the acid soils.

Having supplied an abundance of humus to insure freedom from the drouth, the soil should be plowed deeply and put in excellent shape as early in the spring as possible. An application of 750 to 1000 pounds of a complete fertilizer, 4-10-8 or 500 to 750 pounds of acid phosphate may prove beneficial when broadcasted just before planting.

Systems of Training and Distances for Planting—The three common systems of training the strawberry are the hill, hedge and matted row, and should be considered before laying out the ground. In the hill system no runners are allowed to develop and the planting distances for hand cultivation are: rows 18 to 24 inches apart and plants 14 to 16 inches apart in the row. For horse cultivation place the rows 30 inches apart and hills 12 to 14 inches apart in the row. For this system, very fertile soil, heavy applications of fertilizers and frequent cultivations are necessary. This system is seldom used in the East for commercial plantations but is suited to small areas where constant attention can be given.

The hedge system like the hill system produces large handsome berries and requires constant care. The rows are usually placed 30 inches apart and the plants 18 to 24 inches in the row. Each plant is allowed to develop two, four, or six plants, according to the preference of the grower, after which all runners are kept cut off.

The matted row system is the most common in commercial sections (See front cover). With it, the greatest number of quarts per acre is produced, but the berries are not so large nor so attractive as in either of the above mentioned systems. The cost of management is also less than for either of the preceding systems. The common distance between the rows for the matted-row system is three and one-half to four feet and the distance between plants should be varied to suit the variety. For the Chesapeake and Glen Mary, two feet; for the Sample, Aroma, Parson, Belt, Bederwood, Luther, and Pride of Michigan, two and one-half feet; and for the Dunlap and Michel, three feet is not too far. In planting these distances

be sure to secure a perfect stand so the rows may be completely filled by new plants, making a row about one foot wide with plants six inches apart throughout the row.

Planting. If the plants arrive from the nursery before the ground is prepared for planting, the roots should be cut back to five inches, the bundles broken and the diseased and injured leaves removed; then the plants heeled in to await the time of planting. The best time for setting the strawberry is in early spring—April if possible—although where the runners were rooted in pots the plantings may be made in August. Another important point in setting strawberries is to set the plants to the proper depth (See Fig. 2). If the plants are set too shallow they will not make satisfactory growth; if too deep the crown will decay and the plant will die; if just right—with crown exposed as shown in the illustration—it will be able to endure unfavorable conditions and make satisfactory growth.

Setting the Plants. Either a dibber, trowel, or spade may be used to make the opening in which to insert the plant. If a dibber is used, insert into the soil, force it to one side to make the hole, then place the plant at the proper depth, shake to spread the roots, and remove the dibber. Next thrust the dibber into the soil about four inches from the plant and press back against it to bring the soil into contact with the roots. To finish the operation, place the feet on opposite sides of the plant and press the soil down, then before leaving see that the foot prints are covered with loose soil and that the plant is at the proper depth.

Culture. The value of the strawberry crop will depend largely upon the strength of the plants, which in turn is in proportion to the moisture and fertility available. The moisture is controlled by the soil and by soil drainage. No one can say how many times a plantation should be cultivated each season, but if a dust mulch about two inches deep is maintained between rains and quickly provided after each rain, the number of cultivations need not be considered. All weeds should be kept subdued and the plants properly trained.

Thinning of Strawberry Runners. Where too many runners develop, a large number of weak plants are produced.

To prevent the formation of weak runners, not more than six should be permitted and these placed so that plants will be well distributed. When hoeing, if a weak runner is seen, cut it off even though the plant may not have any other runners to develop.

Mulching. The objects of mulching are:

1. To prevent injury to the plants by alternate freezing and thawing;
2. To conserve moisture;
3. To keep fruit clean by preventing its coming into contact with soil;
4. To secure increased yields.



Fig. 3—Strawberries Mulched With Oat Straw. Much Should be Evenly Distributed Over the Entire Surface.

The mulch may be provided by the application of any one of many materials if free from weed seeds and of such a nature as to not pack firmly. Wheat straw is most desirable; while either oat, rye or barley straw is satisfactory. Shredded fodder, pine needles and marsh hay are other materials sometimes used. Three to four tons of straw per acre (See Fig. 3) should be spread evenly over the entire surface to a depth of about two inches when packed. The usual time for applying the mulch is as soon as the ground is

frozen, usually in early December. It is left on the plants until about the time growth begins in the spring when most of that upon the rows should be raked off the plants and placed between the rows, leaving just enough worked in among the plants to keep the berries off the ground.

Insects and Diseases. The chief enemies of the strawberry besides late frosts and dry weather are white grubs, cut worms, aphids, and leaf rollers and the leaf spot disease.

The white grub and cut worm both are larval forms and spend the winter in that stage in the soil. Both may be partially controlled by fall plowing and by planting to corn, potatoes, or other tilled crops one year before setting to strawberries.

The aphids, particularly the root louse, which is very injurious, are often imported from the nurserymen on new plants. A very convenient and satisfactory way to control this pest when transplanting or when new plants are received is to dip the entire plant in tobacco tea or other tobacco decoctions such as "Black Leaf 40" and sulphate of nicotine. The tobacco tea may be made by pouring one gallon of hot water over each one and one-half pounds of tobacco stems and let stand over night when the solution may be poured off and used without dilution.

The leaf rollers sometimes become so numerous as to do considerable damage. In such cases they may be controlled by spraying with arsenate of lead at the rate of three pounds to fifty gallons of Bordeaux mixture and burning over the patch on a windy day after the leaves have been mowed and allowed to dry. The poison spray is usually applied before the fruit sets and after the berries are harvested.

Strawberry weevil. This minute beetle deposits its eggs in the blossom just before it opens. The stem is partially severed so that the blossom droops and stops growth. The food of the larva is chiefly pollen, consequently imperfect (pistillate) varieties are less injured than the perfect (staminate). Clean and thorough culture together with rotation and burning the foliage as suggested for controlling the leaf roller are the practical ways of combating this pest.

The strawberry leaf spot is a fungus disease which does a great deal of damage. It is common in most straw-

berry patches and is easily recognized by the small, almost circular and usually purplish colored spots upon the foliage. They become grayish and often drop out, leaving holes in the leaves. Sometimes the infection is so extensive that the entire surface of the leaves will take on the peculiar purplish color.

Some varieties are more resistant to this disease than others and may be selected for planting. The leaf spot may be controlled by spraying with 5-5-50 Bordeaux, first when growth begins, later before blooming and then give two more applications after the leaves are mowed and burned at the end of the harvest.

Packages. Whatever the package used, it should be neat and attractive. Standard quart boxes are most commonly used for the strawberry and bush fruits, while the pint boxes are often used for marketing the red raspberries and high priced strawberries. The quart boxes are packed in either the 24, 32 or 48 quart crates. The smaller being preferred by many. These crates are usually made of durable material for local markets, but for shipping, the gift or cheaper crates are used.

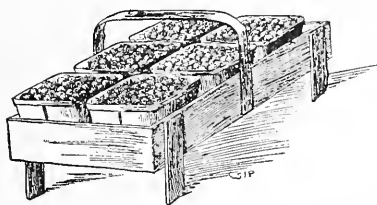


Fig. 4—Picking Stand—Convenient and Useful.

Picking. Frequent pickings, daily in hot weather and every other day in cooler weather are necessary if strawberries are to have an attractive appearance when they reach the consumer. Each picker should be provided with a picking stand which holds 4, 6, or 8 one-quart baskets. Then he should receive definite directions for doing his work and be made to do it according to directions. To see that the pickers get all the ripe berries and do their work properly, commercial growers usually employ one person to oversee the work of each dozen pickers. To make the directions more forceful, the pickers' cards sometimes have the directions printed on the back. Following are the directions on the back of cards used by the Sparta Fruit Growers' Association, Sparta, Wis.

"Rules For Pickers. Adopted by Sparta Fruit Growers' Association.

On entering the field each day be sure you come with the

Pick the Berries With a Short Stem on Each Berry. Do not get dirt and leaves mixed up with the berries. Put no berries in your box that you would not wish to eat yourself. Do not pick green berries. Strawberries must be three-fourths colored; red and black raspberries and blackberries ALL colored. Be sure to fill the boxes full.

One-fourth of one cent per quart will be deducted from all tickets for berries picked by pickers who leave before the season is over unless allowed to go before by the proprietor. One-fifth of the pay for all tickets will be retained until the end of the season. Tickets will be cashed on Wednesday and Saturday."

[illegible]

A cheap ticket punch may be used for punching the numbers corresponding to the quarts delivered by each picker. Should the picking stands accommodate six quart boxes 6's may be substituted for one column and 2's for the other column of 4's.

Grading. The strawberry softens quickly if bruised, hence should be graded by the pickers to avoid extra handling. All soft, overripe and defective berries should be discarded from the marketable grades. Where a fancy product is demanded the marketable berries are usually divided into two grades, fancy and choice. For the fancy grade the top layer should be carefully arranged with stems down and in rows.

Marketing. Little need be said about marketing West Virginia grown strawberries. The markets are here and the growers producing the finest berries and packing them most attractively will have little trouble in finding a market.

Preparations for Second Crop. The mulch should be left between the rows until harvest is over and then raked off or plowed under. Where a second crop is to be secured it will be difficult to plow the mulch under, hence it should either be raked off or burned after mowing the leaves and allowing them to dry. If everything is very dry and a wind is blowing, little damage will result to the plants. Then plow along each side turning the soil from the row and leaving the row about eight to twelve inches wide. Apply about 1000 pounds of a complete fertilizer 3-10-8 along the rows and cultivate the soil back to the plants. Then dig out all weeds, weak plants, etc' and give the same culture as followed the first season, being careful not to allow too many plants to set.

Yields. According to the census the yield of strawberries was 802 quarts per acre for 1909 in West Virginia. W. A. Lawson of Kanawha County says he grows 5,000 to 6,000 quarts, while other successful growers claim a yield of 3,000 quarts as a good average per acre. The yields, largely limited by the variety, soil, care and water supply, frequently reach 6,000 to 8,000 quarts, while 10,000 quarts per acre are sometimes reported. These high yields cannot be obtained except by the most thorough preparation and care, and a yield of 3,000 quarts is more common for fields receiving fair to good soil preparation and culture.

Cost of Production, Returns and Profits. The following data, except the expenses previous to harvest, which are estimated, was collected by Virgil Vandervort and son on their fruit farm at Morgantown in 1914. The area was about two acres, one acre of which was planted in 1912 and fruited its second crop in 1914; the other acre planted in 1913 produced its first crop in 1914. These varieties were Dunlap and Aroma.

Estimated cost of past season's management.....	\$100.00
3616 1-quart baskets @ \$3.00 per 1,000.....	10.85
151 24-quart gift crates @ 10c each.....	15.10
Freight on packages	2.25
Picking 3616 quarts at 2c.....	72.32
Cost of delivery	30.60

Total Expense ----- \$231.12

Returns from the two acres—

752 quarts @ 18c.....	\$135.36
568 quarts @ 12 ½ c.....	71.00
2296 quarts @ 10c.....	229.60

Total returns ----- \$435.96

Total expense ----- 231.12

Net returns, two acres----- \$204.84

Net returns per acre----- 102.42

Most of the work previous to the harvest was done by Mr. Vandervort and son and the plants were home grown, so the actual cash outlay was much less than \$100 up to the time of harvest.

RASPBERRIES.

The season would indeed be improperly provided for if this delicious bush fruit were omitted. It fills in the gap nicely between the strawberry and blackberry harvests, and is prized for its fresh fruit, for canning, for preserves and for jelly. The winter's store would be incomplete without a supply of this fruit. From a commercial standpoint the raspberry ranks high as will be seen in the paragraph on returns.

Species. There are three species of the common cultivated raspberries native to the United States and one European species which has been grown to some extent in America.

The raspberries belong to the genus *Rubus*. The black raspberry (*Rubus occidentalis*) is most common in West Virginia. The red raspberry (*Rubus strigosus*) is second in importance, and the purple-cane (*Rubus neglectus*) is less extensively grown than either, while the European raspberry (*Rubus idaeus*) is not recommended for West Virginia conditions.

The Black Raspberry. (*Rubus occidentalis*.) It was stated that the black raspberry is more extensively grown than any other raspberry in West Virginia. This is due to the fact that it is more productive, a surer bearer, easier kept in control, and ships better than the red raspberries. The fact that Wheeling imported more than 3,000 crates from other states in the spring of 1908 indicates the popularity of this fruit.

Varieties. The varieties such as Doolittle, Ohio, etc., popular a decade ago, have been replaced by the Kansas, Plum Farmer, Gregg and Cumberland which may in turn give place to something better. The black raspberry may be much improved by careful breeding and selecting. No one should be in too big a hurry to try the new varieties extensively for commercial purposes.

Propagation. Where new varieties are desired the black raspberry is propagated by seeds, but where a variety is to be perpetuated and grown commercially the method is by tip-layerage. During the latter part of August the branches of the black raspberry lengthen rapidly and become blunt at the end. When they come in contact with the soil they work their way into it and take root unless the wind or some other force shakes them about too frequently. Where plants are desired, nature may be helped by taking a hoe or spade and covering the tips. Root development takes place quickly and a bud or crown is soon developed at the end of the cane. This is left undisturbed until spring when the parent stem is cut about six inches from the point where tip-layered and the new plant is dug by spade or hoe and transplanted.

Cost of Plants. The black raspberries are usually placed on the market at \$10.00 to \$14.00 per thousand. Where the plants are set 2½ feet by 6 feet it requires 2904 plants per

acre. If the plants are to be purchased they will cost from \$30.00 to \$40.00 per acre. It is usually best, however, to start a smaller acreage from which to secure plants for later plantings.

Site. Under West Virginia conditions the valleys are subject to late spring frosts which are injurious to bush fruits located in such places. For that reason, and because better air drainage is provided at a higher elevation, the site should be well elevated above the valleys. The soil which is usually found in a northeastern cove is generally full of organic matter, loose and fertile. If such soil is well drained and is

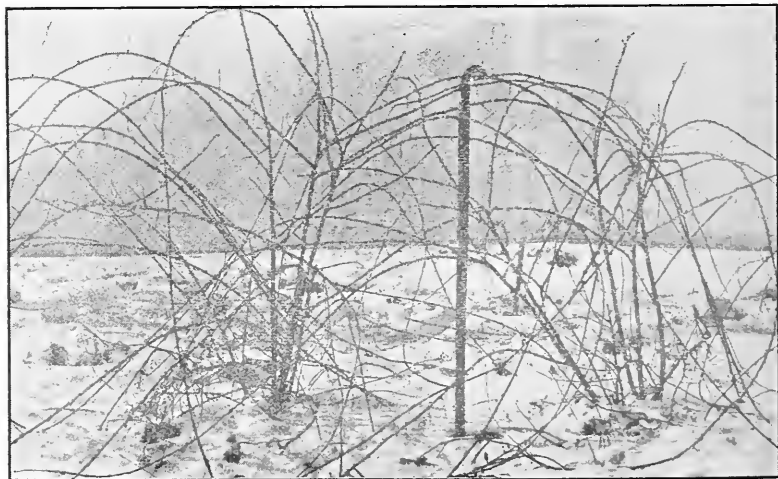


Fig. 5—Black Raspberry Before Pruning. The Pruning Hook Will Show Relative Height Before and After Pruning.

level enough so that it will not wash, it furnishes an excellent site for all brambles. In other words, the bush fruits require a fertile, loose, well drained clay loam soil with good water holding capacity. A dry soil never gives best results for any of the small fruits.

Planting. Early spring is best, however, if the spring work is apt to be so rushing that the bush fruits may be neglected until late spring, fall planting may be safely followed. Placing the plants $2\frac{1}{2}$ to 3 feet apart in rows 6 to

8 feet apart is the most common distance. The soil should be thoroughly prepared, and may then be marked out in straight rows by a single shovel plow leaving a furrow about four inches deep. Few gardening operations are apt to produce poorer results than planting the black raspberry, unless it is properly done. The roots are very fine and the crown weak and tender, therefore they should be protected from the drying wind and sun while being planted. Little if any root pruning is necessary. After furrowing the ground as directed above, follow quickly before the soil dries, setting the plants the desired distance apart and covering to a depth of two



Fig. 6—After Pruning. Same as Figure 5 After Pruning.

inches—not deeper. Firm the soil without injury to the crown. The cultivation will gradually fill the furrow and leave the surface leveled with the crown about four inches beneath.

Culture. Frequent tillage should be given to keep the plants in a vigorous condition. Follow each rain as quickly as possible to insure conservation of the moisture. A cover crop of three bushels of oats or fifteen pounds of crimson clover may be sown about the middle of August and turned under the following spring.

Fertilizers. The black caps will stand heavy applications of manure and fertilizer and respond accordingly. Early spring applications of ten or more tons of manure per acre should be made to supply both plant food and organic matter. There is little known as yet as to the exact type of commercial fertilizer for bush fruits in West Virginia. However, a spring application of 200 pounds of nitrate of soda and 500 pounds of acid phosphate per acre will in many cases give profitable increased returns.

Pruning the Black Raspberry. The season following planting, the shoots should be pinched off when they have reached a height of 12 to 18 inches. To do this it is necessary to visit the patch each week during the time of shoot formation and pinch off about two inches of the top of each shoot having reached the desired height. Do not wait until the shoots are 30 inches long and then cut back to 18 inches. No further pruning will be necessary until the danger of killing weather is past the following winter. In early March, give the dormant pruning as follows (See Figs. 5 & 6):—(1) Remove all canes affected with cane-borers or badly damaged by anthracnose; (2), then thin out the canes leaving 3 to 5 of the strongest in each hill; (3), after this cut back the branches to from 12 to 18 inches long depending on vigor of canes; (4), then remove and burn all prunings to destroy insects and diseases. As soon as the harvest is past prune out and burn all canes that have fruited.

Harvesting. The black raspberry should be picked frequently and only when dry. The berries should be kept in as cool a place as possible while waiting for delivery. Quart boxes are preferred and are packed in either 24-quart or 32-quart crates.

Yields. Yields of 4,000 quarts per acre are frequently reported but 1,800 to 2,000 quarts per acre is a more common harvest. The better the care and the more productive the variety the greater the yield.

Cost of Production, Returns and Profits. The following data shows the cost of harvesting and marketing the black raspberries from a one-acre patch on Mr. Vandervort's farm. The cost of management from the end of the fruiting season

the previous year until the beginning of harvest is estimated.

Estimated cost until harvest-----	\$ 50.00
1868 quart boxes @ \$3.00 per 1,000----	5.60
78 24-quart gift crates @ 10c-----	7.80
Freight on packages -----	1.50
Picking 1868 quarts @ 2c-----	37.36
Cost of delivery to market-----	20.00
Total cost of producing and marketing--	\$122.26

Returns:

380 quarts @ 12 ½c-----	\$ 47.50
1488 quarts @ 10c-----	148.80
Total returns -----	196.30
Total cost -----	122.26

Net returns per acre-----\$ 74.04

Duration of Plantation. Where diseases and insects are troublesome practical growers usually take only three crops and then destroy the plantation. Five to seven years is as long as profitable crops can be expected. Better fruits and better returns can be had by having new plantings coming on frequently.

THE RED RASPBERRY (*Rubus strigosus*)

The red raspberry is increasing in demand and has the following advantages over the black caps: (1) The fruit is richer and more delicately flavored; (2) It is not grown so extensively and there is always a ready market for surplus; (3) The plantation will produce more crops profitably than will the black; (4) The price per quart is usually higher.

Owing to the high quality, few homes can afford to leave this fruit off their garden list.

Varieties. From the many varieties introduced during the last half century, the Cuthbert is the most popular. The King has also become popular in West Virginia, and the Herbert and Marlboro, are worthy of a trial. Because of its earliness, the King is being planted extensively commercially. It must be harvested while the berry is pink or it shakes off badly while being picked. The Cuthbert is the old reliable late variety with larger and richer fruit than the King and

when planted with the latter, it lengthens the berry season. The St. Regis fall-bearing red raspberry is being highly advertised but should not be extensively planted until tested.

Cost of Plants. When the plants are set 3 feet by 6 feet 2420 are required to plant an acre. These may be purchased from reliable nurserymen for \$8 to \$12 per 1,000, for good one year old plants.

Propagation. The red raspberries like other bush fruits do not come true from seed, hence for new varieties seed is planted. Commercially, the reds are propagated by (1) suckers and (2) by root-cuttings. They naturally produce suck-



Fig. 7—Red Raspberries Before Pruning. Note the Continuous Row as Compared with the Hills in Figs 5 and 6.

ers which may be taken up in the fall or spring and planted wherever desired. If root cuttings are desired the patch may be plowed deeply, the largest roots cut into pieces 3 to 4 inches long, and either planted in the nursery row or where they are to remain. They should be planted in furrows about four inches deep, laid flat and covered with two inches of soil. The furrows will be filled as cultivations are given. If planted where the patch is to remain the cuttings should be placed about 18 inches apart in rows 6 feet apart.

Site. What has been said about the site and soil when discussing the black raspberry is applicable to the red raspberry.

Planting. Three feet apart in rows six feet apart is the common distance for planting the red raspberries, and the plants are allowed to make a continuous row about 18 inches wide.

Culture. Clean culture in the strictest sense should be given. Since the red raspberry produces so many suckers it becomes a weed itself, and should be freely thinned out while hoeing. Grass and weeds allowed to develop reduce the yields. Three bushels of oats per acre sown about the middle of August will serve as a satisfactory cover crop. Crimson clover or rye may be used but both are hardy and difficult to eradicate the following spring.

Fertilizers. The following table from a bulletin by the New York Agricultural Experiment Station shows the effect of fertilizer on red raspberries in that state:

Method of Fertilizing	No. of Farms Reporting	No. of Acres Reported	Yield per Acre (quarts)
No manure nor fertilizer----	39	81	1168
Manure and fertilizer -----	13	14	1526
Fertilizer only -----	10	30	1439
Manure only -----	21	23	1472

This table would indicate that a liberal supply of organic matter in the form of manure is as good fertilizer as can be had; and where the manure is not available commercial fertilizer will prove profitable.

Pruning. Like the other brambles the canes of the red raspberry spring up one year, bear fruit the next and then die. The roots are perennial and the canes biennial. The knowledge of this will help the amateur to understand the pruning better. Pruning the red raspberry as practiced by growers in the East is quite simple (see Figs. 7-8). The canes are allowed to grow at will each season. The following spring they are thinned out so that they stand about one to the square foot of space in the row, and the rows are kept from 12 to 18 inches wide to facilitate the harvest. The amount to

cut off the tops depends on the length of growth. If the canes are five feet tall, cut back to four feet; if four feet tall, cut back to three and one-half feet; if three feet tall, cut back to two and one-half feet. Too severe cutting back often reduces the yield.

Harvesting.—The red raspberry should be picked daily to get the greatest yield, and because the berries are soft, varieties like the King must be harvested as soon as pink or they will shell off and be lost. They ripen quickly and satisfactorily after being picked. The pint boxes should be used, but the quart is most common for local markets at the present time.



Fig. 8—Red Raspberries After Pruning. Same as Fig. 7 After Thinning Out and Cutting Back.

Cost of Production and Returns. Mr. Vandervort also kept records on the cost of harvesting and marketing approximately one-half acre red raspberries in 1914 as follows:

852 quart boxes @ \$3.00 per 1000_____	\$ 2.56
36 24-quart gift crates @ 10c_____	3.60
Freight on packages _____	1.00
Picking 852 quarts @ 2c_____	17.04
Cost of delivery _____	11.60
Estimated cost of previous management_____	35.00
<hr/>	
Total cost of producing and marketing_____	\$70.80

Returns:—

388 quarts @ 22c-----	\$ 85.36
464 quarts @ 17 ½ c-----	81.00
<hr/>	
Gross returns -----	166.36
Expenses -----	70.80
<hr/>	
Net returns ½ acre -----	95.56
Net returns per acre-----	\$191.12

Duration of Plantation. Under good management a red raspberry plantation will produce profitable crops for 10 to 12 years, but if diseases or insects become destructive it is better to plow and destroy.

PURPLE CANE RASPBERRIES, (*Rubus neglectus*).

Where the black and red species are found growing together seedling hybrids are apt to develop which may take on the characters of either parent. These hybrids are called purple-cane raspberries.

Varieties. The Columbian and Shaffer are the most extensively planted of the purple cane varieties, the former being preferred. The Royal Purple, a later variety, seems worthy of trial. These hybrids are more productive than either parent, but the color of the fruit is not attractive and the price is not so high. The Columbian is later than the reds or blacks, is of high quality and should be in every home collection of small fruits.

Propagation and Management. Since the purple cane may resemble either parent it is sufficient to say that all operations should be the same as for the parent from which the habit of growth was inherited.

BLACKBERRIES.

The blackberry as found in cultivation is strictly American. Its introduction into cultivation is the most recent of any of the brambles. It is native to the Eastern states and all cultivated varieties have been developed from the native wild species, during the last half century.

Species. All the more common varieties of blackberries belong to the species known as *Rubus nigrobaccus* and

Rubus argutus. The latter is recognized by the leafy development in the cluster of berries, while the former does not have such a growth of leaves.

Varieties. From the species *Rubus nigrobaccus* the following long clustered varieties have been developed: Eldorado, one of the most profitable where orange or blackberry rust is not common; Taylor, a greenish caned, very hardy variety; Blowers, a new variety especially desirable for very fertile soils.

From the short clustered class, which is known as *Rubus nigrobaccus sativus* a sub-species of the former, the following

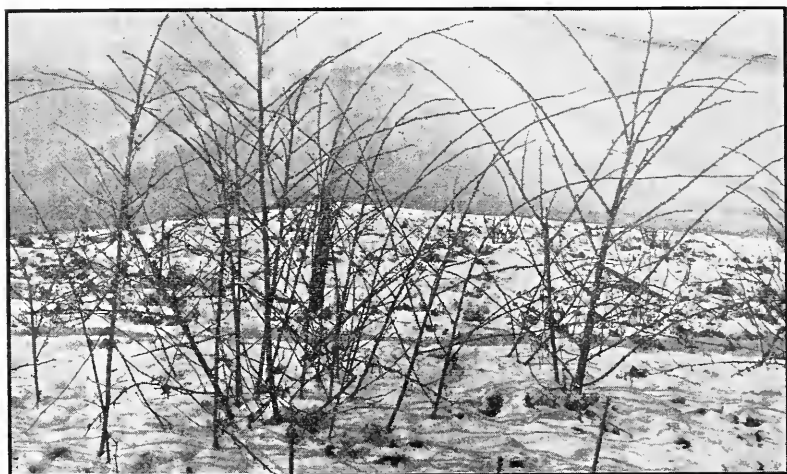


Fig. 9—Blackberry Canes Before Pruning.

varieties have become popular: Snyder, one of the hardiest and most resistant to rust, a reliable and widely planted variety; Western Triumph, a variety worthy of trial; Mersereau and Lawton are other varieties.

From the leafy clustered *Rubus argutus*, two varieties of importance to West Virginia have been developed: The Early Harvest, one of the most profitable, and the Early King, both of which are very early.

From the varieties mentioned the following in order of ripening are recommended for general planting: Early Harvest, Eldorado (where blackberry rust is not common) and

Snyder. The following are worthy of trial: Blowers, Western Triumph, Early King and Joy.

Cost of Plants. When the plants are set 3 feet apart in rows 8 feet apart, 1815 plants will be required per acre, at a cost of about \$8 to \$12 per 1000.

No further discussion of the site, soil, planting, culture, and fertilizer than that already given for the black raspberry and the propagation of the red raspberry is required.

Pruning. The habit of growth of the blackberry is similar to that of the red raspberry. Suckers develop very freely,

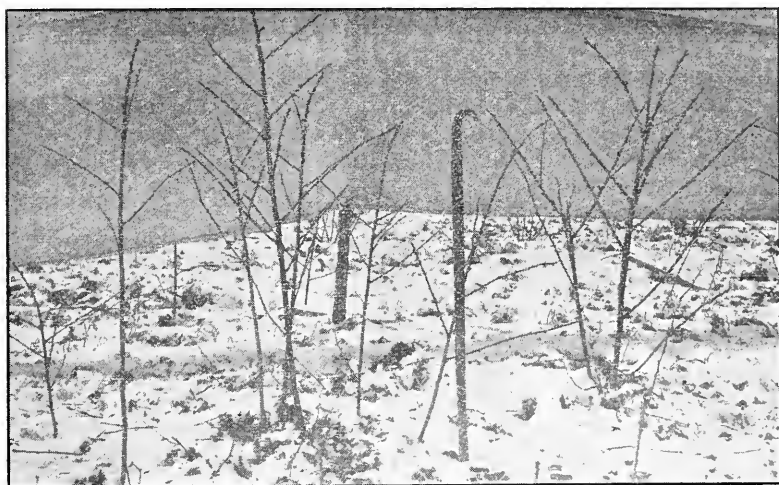


Fig. 10—Blackberry Canes After Pruning. Same as Fig. 12 After Thinning Out and Cutting Back.

and branching is common. Therefore to prune this bramble (see Figs. 9-10) the canes infected with diseases and insects are first removed and the remaining canes are trimmed to a narrow continuous row, allowing the canes to stand about a foot apart in the row. Having thinned the row, too heavy pruning of the laterals will give reduced yield while too light pruning will produce more berries than the canes can properly mature. The length to leave the laterals depends on the variety and the amount of growth. The first two to four buds next to the main cane on each lateral usually do not produce

fruiting shoots, therefore to get fruit, more buds than that must be left. It is plain, then, that the person pruning the blackberry must study the operations for more than one season in order to get the maximum results, but for general practice the laterals may be cut back to 14 to 18 inches in length.

Harvesting and Marketing. Some experience is needed to properly harvest the blackberry, because the berries of many varieties turn black before they are ripe. If picked before they are ripe the berries are sour and astringent, while if allowed to properly mature on the canes they are sweet and delicious. This fruit is tender and must be handled carefully after picking to prevent crushing, and must be kept in cool shady places to prevent the development of a dull reddish brown. The blackberry is usually picked in quart baskets and placed in 24 or 32 quart crates for market. If possible, the berries picked in the forenoon should be marketed in the afternoon, and those picked in the afternoon marketed the next morning. Being a soft berry it does not stand shipping well.

Yields. The blackberry is the most productive of the brambles. Reports from 50 growers in New York give yields from 1280 to 10,000 quarts per acre with an average of over 3000 quarts. This berry yields good crops with poor care but responds quickly to proper treatment. A yield of 2000 to 3000 quarts being a fair average under ordinarily good management.

Cost of Production and Profits. Mr. Thayer, a practical grower, quoted by W. F. Card in his text on "Bush Fruits" says that a yield of 200 bushels will give a net profit of \$250 while a yield of 100 bushels will give a profit of only \$80; and 50 bushels per acre no profit at all. This is the experience of a practical grower and emphasizes the fact that thorough preparation and good care should be given if we are to be pleased with the yield. Nature does not make a practice of giving "something for nothing."

Duration of Plantation. If properly cared for, satisfactory crops can be expected for ten years. If, however, the orange rust or cane borers are allowed to develop at will the life of the plantation will be shorter.

INSECTS AND DISEASES AFFECTING BRAMBLES

Because most of the insects and diseases listed below infest, the various species of brambles, they are all grouped together in preference to describing them under the various brambles.

INSECTS

The Raspberry Root Borer (Blackberry Crown Borer) is rarely seen or even accused of the damage which it causes. When growth starts in the spring canes may be found dead. Winter injury is usually blamed, when the real cause is apt to be this borer in the root. **Remedy.** Dig out and destroy all canes which do not start growth.

The Red-Necked Cane-borer. Enlargements may be found anywhere along the canes on the raspberries and blackberries. A cross section will show spongy tissue with minute larvae in it. This enlargement will usually kill the part above the swelling. **Remedy.** When giving the dormant pruning watch for these gall-like growths which should be cut out and burned.

The Raspberry Cane-borer. Two rows of punctures an inch or more apart may be found girdling the new shoots in June or early in July. These are made by the cane-borer, the egg of which is located between these rows of punctures. When the tip wilts, the borer starts down the cane and often reaches the root by fall, resulting in the death of the cane. **Remedy.** Watch for wilting and cut out and destroy the wilted portions.

The Snowy Tree-Cricket. The presence of this insect is known by the egg punctures which are so close together on the raspberry canes that a continuous slit an inch and one-half to three inches in length is made longitudinally. In spring when growth begins, the eggs hatch and the insects escape. **Remedy.** Cut out and burn infested canes.

DISEASES OF BRAMBLES

Orange Rust or Red Rust of blackberry and raspberry.

This is a fatal disease on many varieties of blackberries and raspberries. It is known by the orange coating on the leaves. **Remedy.** Where common on wild berries, plant resistant

varieties such as the Snyder, and watch for signs of its development early in the season. Keep watch through the season and destroy all infected plants at first appearance of yellow spots on the under side of the leaves. As soon as the patch becomes unprofitable, destroy. Wait a year or two and start again.

Anthracnose. This is the most dreaded of the raspberry diseases and is easily recognized by grayish sunken spots on the canes and brownish spots on the leaves. These often become so numerous as to girdle and destroy the canes. **Remedy.** Prune out and destroy the worst infected canes. Provide good air drainage, and have new plantings from healthy plants coming on every two or three years. Spraying with Bordeaux 5-5-50 before growth starts and every ten days thereafter will hold the disease in check, but spraying has not generally proved profitable for the control of this disease.

Crown-Gall. This disease is readily recognized by the knotty growths at or below the surface of the ground. Sometimes these enlargements or galls become several inches in diameter. This disease is very injurious to raspberries and other fruits and plantings should not be made when it is found on nursery stock or in plantations from which plants are taken. The only remedy practicable is prevention, therefore avoid planting infected stock from places where the disease is known to exist in the soil.

CURRENT.

The currant is native to both Europe and America. Most of the cultivated varieties have, however, been introduced from Europe or are seedlings from those so introduced. The red and white currants belong to species known as *Ribes rubrum*, to which practically all the currants grown in America belong. A few of the black currants, *Ribes nigrum*, are found in home gardens, but the flavor is not liked by most Americans. The demand for currants is strong and a steady increase in the demand is noticeable, large plantings, however, should not be made unless a market is assured.

Varieties. Perfection, Cherry, Fay (Fay's Prolific) Prince Albert, Victoria and Wilder are the leading red varieties; White Grape is the most popular white currant; and Lee's Prolific and Black Naples are the principal black currants. Fay, Perfection, Cherry, White Grape, and Black Naples would make a good home collection.

Cost of Plants. In small lots currant plants one year old may be had for 75c to \$1.25 per dozen or \$4.50 per hundred. Plants to set $\frac{1}{4}$ acre, enough to start with commercially, can be had for \$18 or less. Larger plantings should not be made until the market demand is known to be sufficient for the increased acreage.

Propagation. Bailey in his text "The Nursery Book" gives the following directions for propagating the currant: "New varieties are grown from seeds, which may be sown in the fall or stratified until spring. Commercial varieties are nearly always multiplied by hardwood cuttings. The cuttings may be made in the spring and placed directly in the ground, but better results are obtained by taking them in the fall or late summer. Many nurserymen prefer stripping the leaves off and making the cuttings in August, tying in bunches with butts even, and burying with the butts up. They may remain in this condition all winter and be placed in the nursery row the next spring. The strongest plants will be ready for transplanting after one year's growth, while the weaker ones should remain in the nursery row two years." The currant is often propagated by mound layerage for home plantings, (See gooseberries).

Site. The currants and gooseberries are absolutely hardy with respect to cold, but are easily overcome by heat and drouth. They are fine rooted, shallow feeders. They begin growth very early in the spring and the blossoms open early. In view of these facts the site should be selected in as cool a place as possible, where the air drainage is good, the soil heavy, fertile and well drained but with an abundance of organic matter to insure an abundant water supply. A clay-loam to heavy clay, located in a northeast cove where water and air drainage are good will give best results.

Planting. The currants and gooseberries begin growth

very early in the spring. They are hardy and fall plantings will give best results, although very early spring planting is satisfactory. The most common arrangement is to have the rows 6 feet apart and the plants 4 feet apart in the rows. Set deep enough to have a few buds beneath the soil to provide suckers for renewals.

Culture. Where a small planting is made, a mulch of three or four inches of manure, over which straw is placed four or five inches deep, or deep enough to keep the weeds and grass down, and the soil cool, is satisfactory. Those

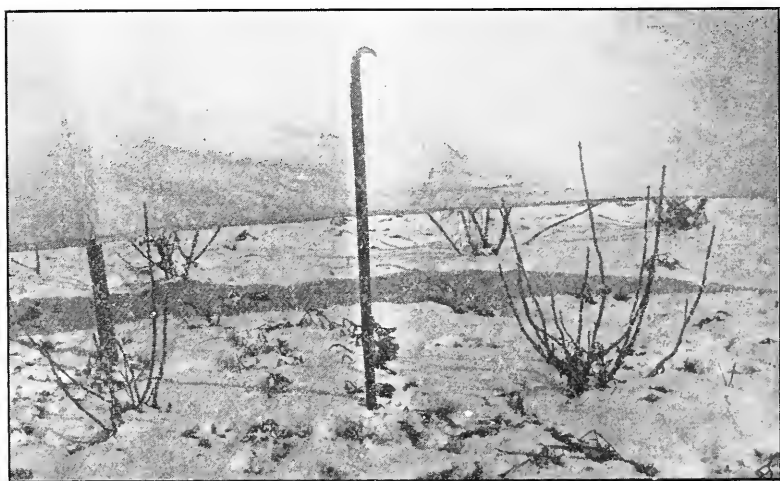


Fig. 11—Currant Before Pruning: Planted One Year.

who have tried mulching are well pleased with the results, and recommend it on small patches or home plantings. Clean culture is practiced on large plantings and where mulching material is not available.

Fertilizers. Liberal applications of manure will prove as beneficial as any form of fertilizer. To the 10 to 20 tons of manure may be added about 750 to 1000 pounds of a high grade fertilizer 4-8-10. The currant is a heavy feeder and some one has said it will use, profitably, almost as much plant food as can be given it.

Pruning. In West Virginia few currants are pruned severely enough. The wood of the past season bears some

large fruit near the base of the cane; two and three year old wood gives the best and most fruit, while older wood produces smaller inferior fruit. Therefore all wood over three years old should be removed (See Figs. 11-14). The following directions as given by Prof. C. S. Wilson, of Ithaca, N. Y., are well summed up, and should be followed in pruning both the currant and the gooseberry:

"At Planting (First Spring). The plant should be pruned to a single branch, which is headed back to five or six buds.

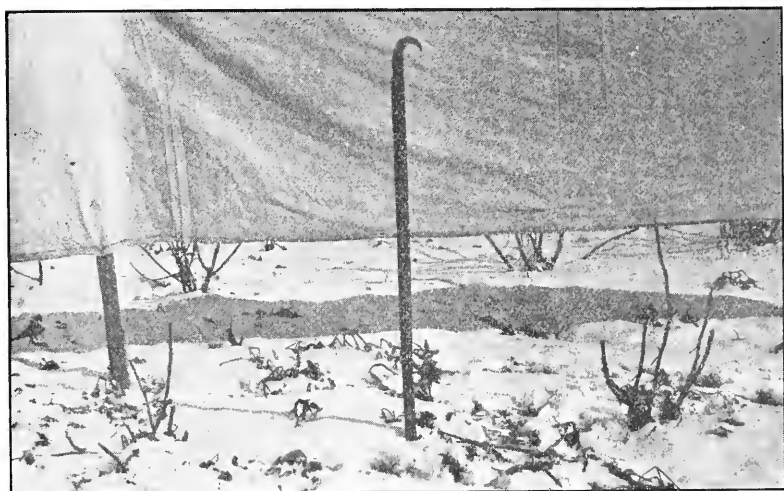


Fig. 12—Currant After Pruning. Same as Fig. 10, But Pruned. Gooseberries and Currants Are Pruned Very Much Alike.

"Second Spring. Five or six branches are chosen to make the framework of the bush; the others are cut out. If any of these five or six branches have grown too long, they should be headed in so that all are of uniform length.

"Third Spring. The plant is thinned out to the desired form and the branches that have grown too long are headed in.

"Bearing Plants. All wood over three years old should be removed and the branches thinned if necessary. Branches that

touch the ground should be removed, because they hinder air circulation, and the berries produced thereon are apt to be dirty. Dead and diseased branches should be removed. An open head is helpful in the control of disease, since it insures a freer circulation of air and more sunshine. The pruning is usually done in the spring, although it may be done either in autumn or spring."

Spraying. See under insects and diseases of gooseberry.

Harvesting and Marketing. The currant is either harvested green or ripe according to the market demands. In



Fig. 13—Gooseberry Before Pruning. Planted Three Years.

either case the entire cluster is picked and care should be used not to crush the berries. Quart baskets placed in 24 or 32 quart crates are usually used in West Virginia, although the grape baskets are popular in other states and may be used. The local markets are not usually fully supplied and where currants do well, plantings will be sure to prove profitable.

Yields, Returns and Profits. A yield of 2000 to 3000 quarts per acre is about the average. The price will easily average ten cents per quart on the West Virginia markets. The cost of production after the patch is in full bearing is given

at about \$50. The cost of harvesting and marketing will depend largely on the yield. The profits should easily be \$100 per acre, on a well cared for patch, near a good market. Much higher profits are reported and are possible where good care is given.

Duration of Plantation—Card, in his text, says, "Practical growers find it advisable to replant after 8 or 10 years of service. Larger better fruit is borne on young bushes, although the currant will continue to produce for many years."

GOOSEBERRIES

Gooseberries are the least popular of all bush fruits, although they are highly prized by many. They are native to both Europe and America.



Fig. 14—Gooseberry After Pruning. Same as Figure 13, but Pruned

Species and Varieties. The European varieties are classed as *Ribes grossularum* and furnish such large fruited varieties as Indusry, Crown Bob, Wellington Glory, and Chatauqua, all of which are subject to mildew in America and are seldom recommended for commercial planting, but may be planted in the home garden. The American species, *Ribes oxycanthoides* furnishes the commercial varieties for the eastern states; Downing, Houghton, Carrie, Pearl and Champion being the principal ones. The Carrie is a new variety, gain-

ing in popularity, but not planted as extensively as the great American variety—the Downing. The Houghton is a sure cropper, but fruit is small.

Cost of Plants. Because of the difficulty of propagation, the gooseberry is more expensive than the other bush fruits. The catalog prices vary from \$1.00 to \$2.00 per dozen and \$7.00 to \$10.00 per hundred depending on the ease of propagation.

Propagation. Seedage for new varieties and mound layerage for multiplying a variety, are the common methods of propagation. Some of the larger stemmed varieties will propagate readily from cuttings. (See currants).

Mound Layerage. In the fall after growth has ceased all main branches are headed in to stubs 4 to 6 inches long. A large number of new strong shoots will develop the following season. About the 1st to the 15th of July, when the shoots are almost mature, the soil should be rounded up to cover the base of each shoot, being careful to work the soil in between the branches. Roots develop on each branch quickly and that fall or the following spring each plant should be removed and placed in the nursery row or set in the permanent plantation.

Pruning. The directions for currant pruning are applicable to the gooseberry. (See Figs. 11-14). Be sure to prune heavily enough each year to induce strong new shoots to develop.

Harvesting. The gooseberry is usually harvested green, but when Americans come to understand better the quality of the ripe fruit, the gooseberry will become more popular. The green gooseberries are harvested quickest and cheapest by using thick leather gloves and stripping the berries from the branches. Many leaves will be pulled off by this method but these can easily be removed by a fanning mill after which they may be marketed in quart baskets and usually sell for five to ten cents per quart.

Yields, Returns and Profits. A yield of 2500 to 3000 quarts per acre is about the average production for the gooseberry on good sites. The cost of production should not

exceed \$50, and the profits usually average \$50 to \$75 or more per acre.

Duration of Plantation. About the same as for the currant.

Insects and Diseases of Currant and Gooseberry.

The **currant worm** is the principal insect affecting these plants. It is a ravenous feeder that works upon the foliage and quickly defoliates the bushes. Its early appearance and feeding habit make it so easily controlled that a person should be ashamed to let it continue its work. **Remedy.**

Just before the blossoms open, spray the vines, using one ounce of arsenate of lead per gallon of water, being careful to spray the under sides of the leaves as well as the top. If the worm gives further trouble use white hellebore, one ounce to two gallons of warm water as often as necessary. Other leaf eating larvae upon these plants may be controlled by the above treatment.

The San Jose Scale. This minute sucking insect attacks not only the fruit trees but also currants and gooseberries. Its rapid reproduction makes it very destructive to these fruits, and unless it is quickly destroyed it will kill them in two or three years. **Remedy.** Give two applications of lime sulphur solution each year, being careful to cover all parts of the plants and to soak the ground at the base of each. Dilute the lime sulphur solution testing 32 degrees Baume with eight parts of water to one part of the solution before applying.

Gooseberry Mildew. This fungous disease is seriously only on the European varieties of gooseberries such as the Industry, the Crown Bob, etc. It attacks the new leaves and tender shoots causing decrease in vitality and early dropping of leaves. As a result of these injuries the plants are not able to produce a good crop the following year.

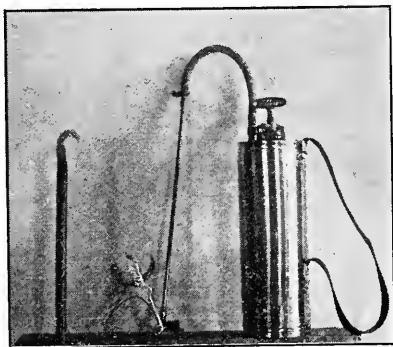
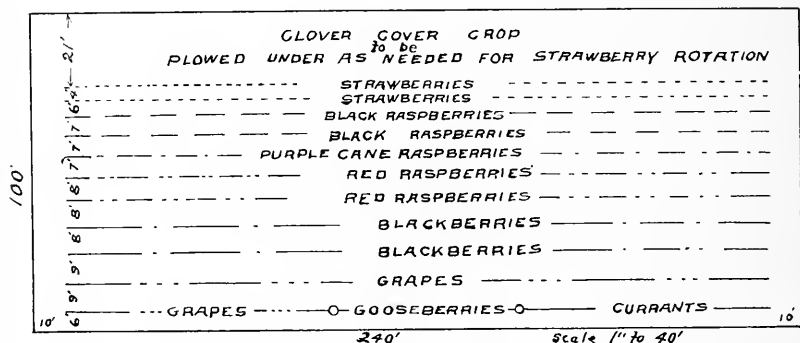


Fig. 15—Three Useful Implements. The Bramble Hook, Pruning Shears and Auto Spray Pump.

Control Measures. Provide good air drainage and spray with potassium sulphide, one ounce to each two gallons of water, when the buds begin to swell, and each ten days to two weeks following.

SUGGESTIVE PLANS FOR FARMER'S HOME SMALL FRUIT GARDEN FOR A FAMILY OF FIVE OR MORE



25 Currants, 10 Gooseberries, 37 Grapes, 150 Blackberries, 150 Red Raspberries, 75 Purple Cane Raspberries, 150 Black Raspberries, 180 Strawberries, with extra space for Strawberry Rotation, planting two rows each year.

Books on Small Fruits.

Bush Fruits—by Card, (\$1.75) The Macmillan Co., New York.
Biggle Berry Book, (\$.50) Wilmer Atkinson Co., Philadelphia.
Modern Strawberry Growing—by Wilkinson, (\$1.25), Doubleday Page and Co., New York.

Bulletins. The following free Farmers' bulletins may be had by writing the U. S. Department of Agriculture, Washington, D. C., or the Congressman from your district.

- No. 154 The Home Fruit Garden.
- 157 Propagation of Plants.
- 198 Strawberries.
- 213 Raspberries
- 643 Blackberry Culture.

